

# Economic Significance of Bristol Bay Salmon Resources

## Overview of Planned Work and Preliminary Findings of “Economics Team” for the USEPA Bristol Bay Assessment

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## Outline of presentation

1. Overview of “Economics” Team and Planned Analysis
2. Commercial Fishery
3. Other Fisheries and Values
4. Economics Impacts

# 1. Overview of Economics Team and Planned Analysis

## Economic analysis: what we are and aren't doing

- WHAT WE ARE DOING
  - Characterization of economic significance of:
    - Commercial fishery
    - Non-commercial fisheries and non-use values
  - Economic impacts of fisheries on local, state & national economies
- WHAT WE AREN'T DOING:
  - Economic study of Bristol Bay region economy
  - Economic analysis of mining
  - Assessment of economic effects of potential mining scenarios

## Economics Team

|                      | Organization            | Responsibility  |
|----------------------|-------------------------|---|
| John Duffield (lead) | Bioeconomics            | Economic significance of non-commercial fisheries (sport, subsistence) and non-use values |
| Gunnar Knapp         | UAA/ISER                | Economic significance of commercial fishery   |
| Tobias Schwoerer     | UAA/ISER                | Economic impacts of fisheries on local, state and regional economies                      |
| Jenny Thomas         | EPA<br>(Washington, DC) | Coordination of economic analysis with other project analysis                             |

## "Economics Team" Contractual Arrangements and Schedule

- Working under contracts between Natureserve and:
  - Bieconomics (Duffield)
  - University of Alaska Anchorage (Knapp, Schwoerer)
- Contracts finalized early July 2011
  - We have only been working several weeks
- Work is scheduled for completion:
  - August (commercial analysis)
  - September/October (other analysis)

## 2. Commercial Fishery

## Economic significance of commercial salmon fishery

- Most straightforward part of the analysis
  - Lots of data
  - Data are accurate
- Commercial fishery is of world-scale economic significance
- Easier to understand and measure than non-commercial fisheries
- Risks:
  - Overemphasis on commercial fisheries
  - Lack of appreciation of economic significance of non-commercial fisheries



There are many potential measures of economic significance of the  
Bristol Bay commercial salmon fishery

- Absolute measures
  - Catches, harvest value, wholesale value, employment, earnings etc.
- Comparisons with other fisheries
  - Other sockeye fisheries, other Alaska & US & world fisheries
- Relative to other economic activities
  - Relative share of employment and earnings in the local, state & national economy
- Who participates and benefits
  - Relative share of local residents, other Alaskans, and non-residents in catches, earnings and employment
- No single “best” measure
  - What’s “best” depends on the question you are trying to answer
- Report will compile all of these measures

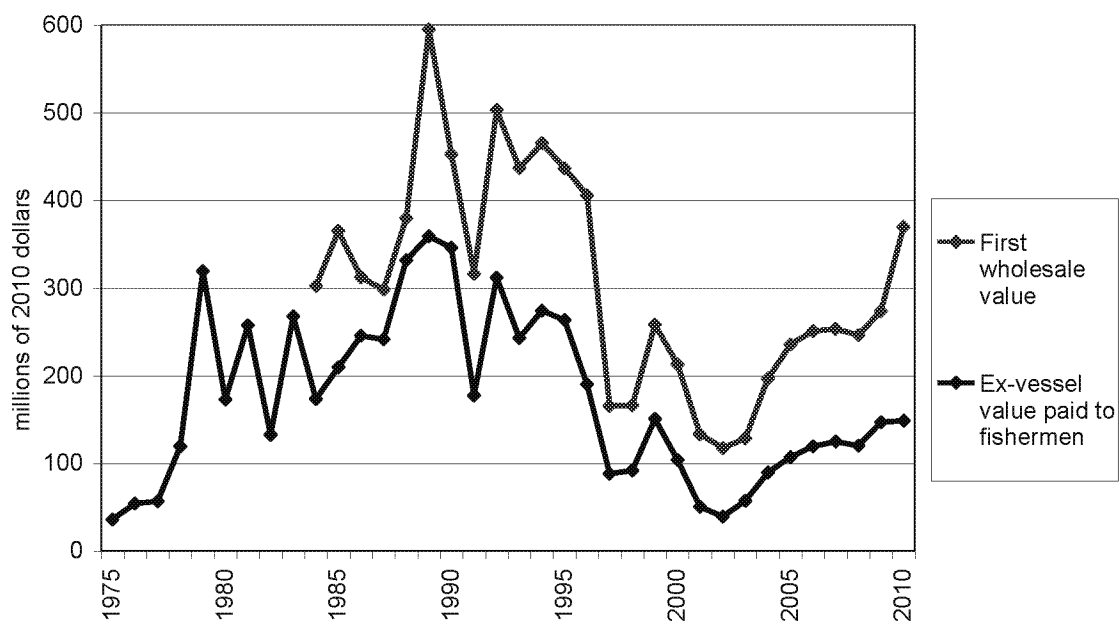
## Selected "absolute" measures of the economic significance of the Bristol Bay commercial salmon fishery

Economic Significance of the Bristol Bay Commercial Salmon Fishing Industry: Selected "Absolute" Measures

| Type of measure   | Measure                                     | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  |
|---|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Physical measures (sockeye salmon only)   | Harvests (mill. fish)                       | 20.5  | 14.2  | 10.7  | 14.8  | 26.3  | 24.5  | 28.5  | 29.8  | 27.7  | 30.9  | 28.6  |
|   | Harvests (mill. lbs)                        | 125.5 | 95.6  | 65.0  | 93.4  | 151.7 | 155.0 | 164.5 | 173.3 | 159.9 | 183.1 | 155.9 |
|   | Production (mill. lbs) (a)                  | 79.3  | 60.8  | 45.0  | 56.9  | 90.7  | 99.4  | 108.8 | 103.9 | 93.5  | 104.0 | 112.8 |
| Nominal value<br>(not adjusted for inflation,<br>millions of \$)<br>(sockeye salmon only) | Harvests (b)                                | 80.3  | 40.2  | 31.8  | 47.6  | 76.5  | 94.6  | 108.6 | 115.8 | 116.7 | 144.2 | 148.7 |
|   | Production (c)                              | 164.7 | 106.1 | 95.3  | 106.8 | 168.3 | 207.5 | 228.0 | 235.2 | 239.3 | 268.9 | 369.8 |
| Real value<br>(adjusted for inflation,<br>millions of 2010 \$)<br>(sockeye salmon only)   | Harvests (b)                                | 103.8 | 50.5  | 39.3  | 57.2  | 89.5  | 107.4 | 119.5 | 124.6 | 120.2 | 146.8 | 148.7 |
|   | Production (c)                              | 213.0 | 133.4 | 117.6 | 128.3 | 197.0 | 235.7 | 251.0 | 253.3 | 246.4 | 273.7 | 369.8 |
| Employment  | Estimated July employment in salmon fishing |       | 7,098 | 5,514 | 6,465 | 6,513 | 6,750 | 6,936 | 6,891 | 6,969 | 6,768 |       |
|   | Number of fish processing workers           |       | 2,862 | 2,273 | 2,484 | 3,474 | 3,272 | 2,940 | 3,512 | 3,952 | 4,522 |       |

(a) Volume of canned, frozen and fresh products produced; (b) Ex-vessel value paid to fishermen; (c) First wholesale value paid to processors. Note: blank cells indicate data are not available.

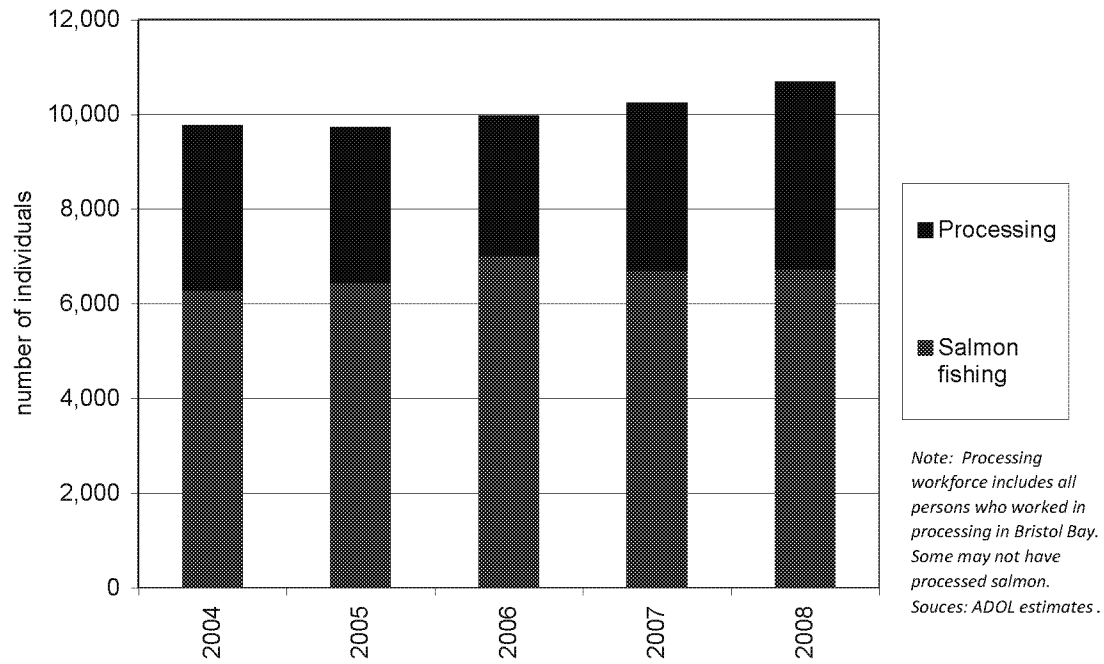
### Real Value of Bristol Bay Harvests and Production (adjusted for inflation)



Source: Alaska Department of Fish and Game;

Every year, about ten thousand people work in salmon fishing or processing in Bristol Bay.

Estimated Salmon Fishing and Processing Workforce in Bristol Bay



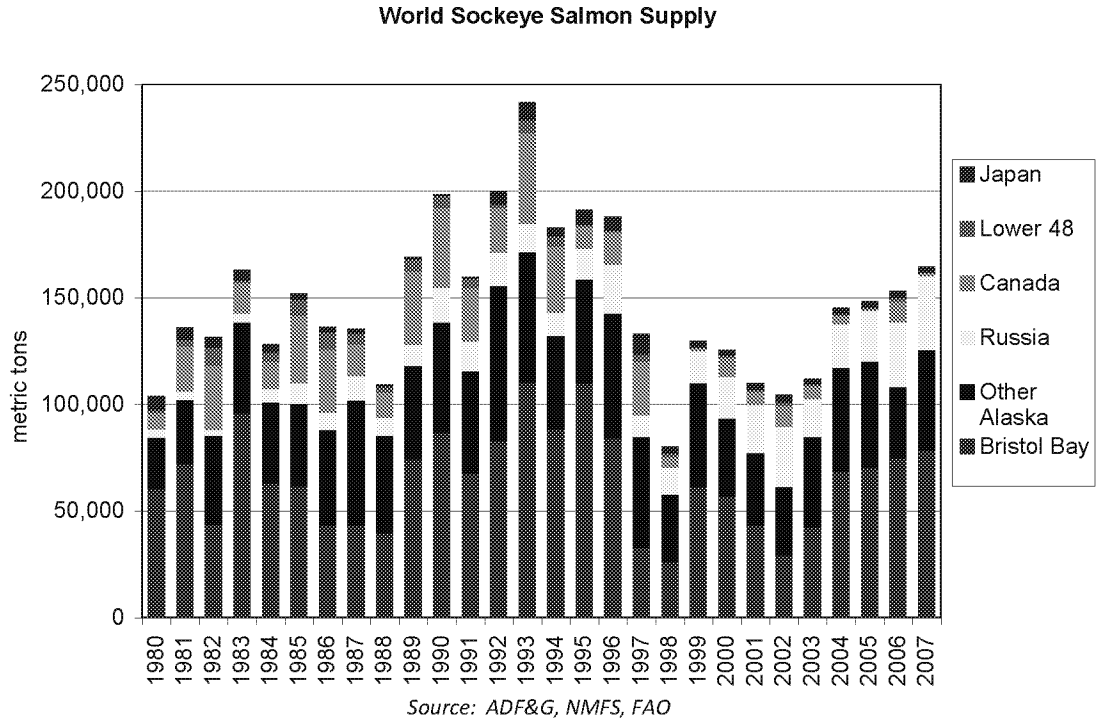
## Selected measures of the economic significance of the Bristol Bay as a share of Alaska and world salmon fisheries

**Economic Significance of the Bristol Bay Commercial Salmon Fishing Industry**  
**Selected Measures of Importance Relative to Alaska and World Salmon Harvests**

|                               |   | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|-------------------------------|---|------|------|------|------|------|------|------|------|------|------|
| Share of<br>harvest<br>volume | Alaska sockeye salmon                           | 61%  | 56%  | 48%  | 50%  | 59%  | 58%  | 69%  | 62%  | 71%  | 71%  |
|                               | World sockeye salmon                            | 45%  | 40%  | 28%  | 38%  | 47%  | 47%  | 49%  | 47%  | 52%  | 55%  |
|                               | Alaska wild salmon (all species)                | 18%  | 12%  | 10%  | 13%  | 19%  | 16%  | 22%  | 18%  | 23%  | 25%  |
|                               | World wild salmon (all species)                 | 7%   | 5%   | 4%   | 5%   | 8%   | 7%   | 8%   | 7%   | 9%   | 7%   |
|                               | World wild and farmed salmon (all species)      | 3%   | 2%   | 1%   | 2%   | 3%   | 3%   | 3%   | 3%   | 3%   | 3%   |
| Share of<br>harvest<br>value  | Alaska wild salmon harvest value (all species)  | 23%  | 14%  | 16%  | 19%  | 24%  | 24%  | 28%  | 24%  | 22%  | 29%  |
|                               | World wild salmon harvest value (all species) * | 12%  | 6%   | 6%   | 8%   | 13%  | 12%  | 13%  | 11%  | 10%  | 9%   |

\* Valued at average prices of Alaska wild salmon, by species

Bristol Bay accounts for about half of total world harvests of sockeye salmon.

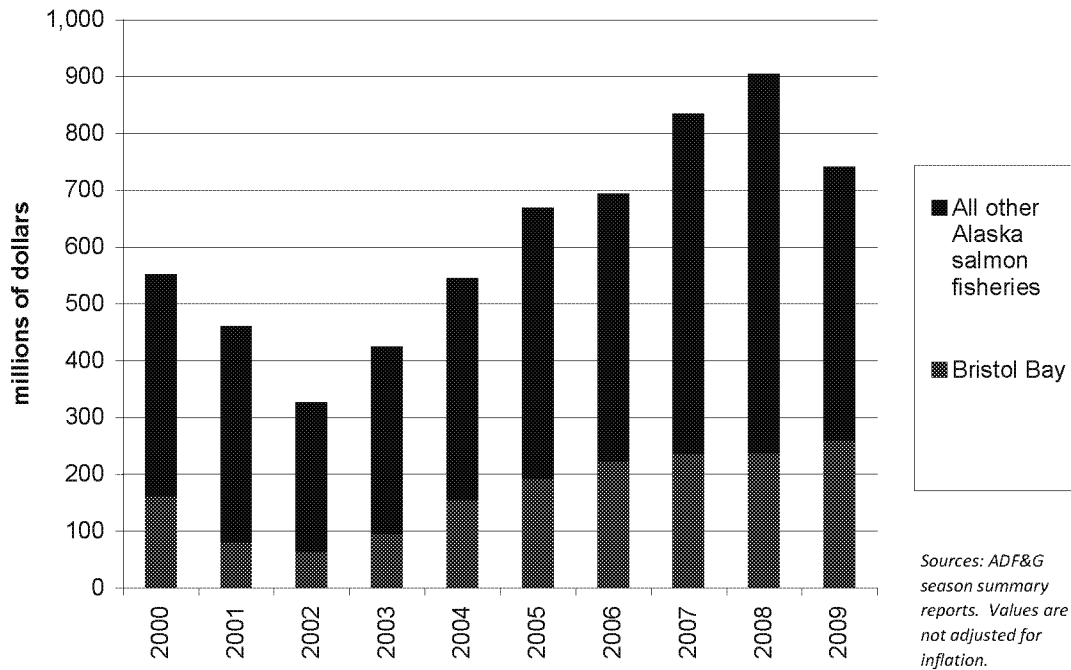


The Bristol Bay drift gillnet fishery is Alaska's most valuable salmon fishery, by far. The Bristol Bay set gillnet fishery ranks eighth.

| Salmon Fishery                     | Average ex-vessel value (\$),<br>2006-2008 |
|------------------------------------|--|
| Bristol Bay drift gillnet          | 94,884,153                                 |
| Southeast purse seine              | 36,659,548                                 |
| Prince William Sound purse seine   | 31,984,385                                 |
| Statewide power troll              | 30,715,171                                 |
| Prince William Sound drift gillnet | 30,149,744                                 |
| Kodiak purse seine                 | 22,570,275                                 |
| Southeast drift gillnet            | 19,384,099                                 |
| Bristol Bay set gillnet            | 18,575,081                                 |
| Alaska Peninsula drift gillnet     | 11,892,333                                 |
| Alaska Peninsula purse seine       | 11,212,939                                 |
| All other fisheries combined       | 46,762,222                                 |

Since 2000, Bristol Bay has accounted for more than one-fourth of the total value of all Alaska salmon harvests. In some years (such as 2009) Bristol Bay has accounted for more than one-third of total statewide salmon value.

**Ex-Vessel Value of Total Alaska Salmon Harvest (All Species)**





## Selected measures of who participates in and benefits from the Bristol Bay commercial fishery

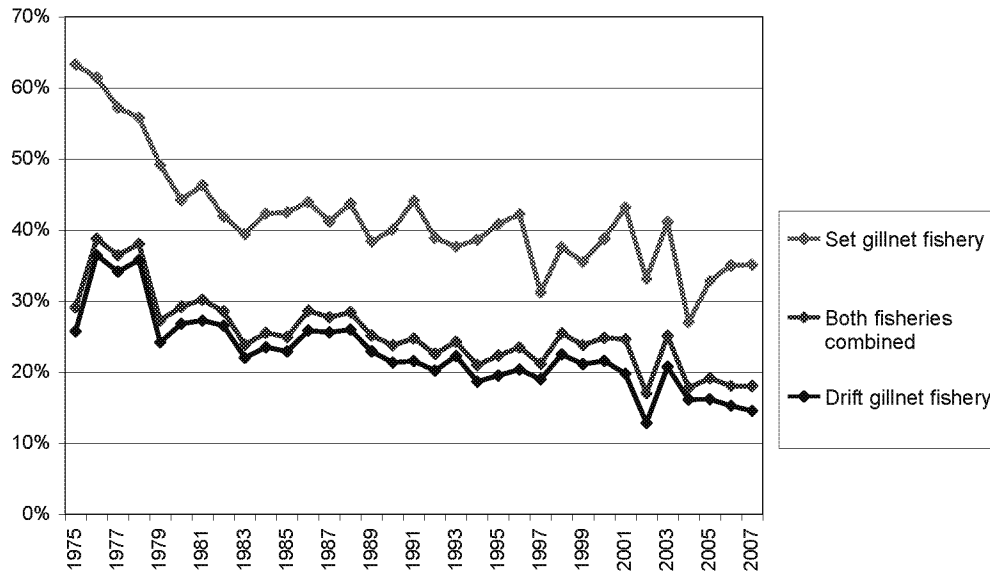
**Selected Measures of Who Participates in and Benefits from the Bristol Bay Commercial Salmon Fishery**

|  |                      | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|--|----------------------|------|------|------|------|------|------|------|------|
| Local Bristol Bay residents            | Drift net permits    | 24%  | 24%  | 24%  | 23%  | 22%  | 21%  | 21%  | 21%  |
|  | Set net permits      | 40%  | 39%  | 40%  | 40%  | 38%  | 37%  | 36%  | 37%  |
|  | Total permits        | 30%  | 29%  | 29%  | 29%  | 27%  | 27%  | 26%  | 26%  |
|  | Drift net earnings   | 22%  | 20%  | 13%  | 21%  | 16%  | 16%  | 15%  | 15%  |
|  | Set net earnings     | 39%  | 43%  | 33%  | 41%  | 27%  | 33%  | 35%  | 35%  |
|  | Total earnings       | 25%  | 25%  | 17%  | 25%  | 18%  | 19%  | 18%  | 18%  |
|  | Fish processing jobs |      |      |      |      | 4%   | 4%   | 4%   | 4%   |
| Other Alaska residents                 | Drift net permits    | 26%  | 27%  | 27%  | 26%  | 27%  | 27%  | 27%  | 27%  |
|  | Set net permits      | 32%  | 33%  | 32%  | 32%  | 33%  | 33%  | 33%  | 32%  |
|  | Total permits        | 28%  | 29%  | 29%  | 28%  | 29%  | 29%  | 29%  | 29%  |
|  | Drift net earnings   | 24%  | 23%  | 25%  | 23%  | 25%  | 24%  | 26%  | 26%  |
|  | Set net earnings     | 33%  | 32%  | 32%  | 30%  | 35%  | 33%  | 32%  | 31%  |
|  | Total earnings       | 26%  | 25%  | 27%  | 25%  | 26%  | 25%  | 27%  | 26%  |
|  | Fish processing jobs |      |      |      |      | 13%  | 14%  | 12%  | 9%   |
| Residents of other states or countries | Drift net permits    | 50%  | 49%  | 50%  | 50%  | 51%  | 52%  | 52%  | 52%  |
|  | Set net permits      | 27%  | 28%  | 29%  | 29%  | 29%  | 30%  | 30%  | 31%  |
|  | Total permits        | 42%  | 42%  | 42%  | 43%  | 43%  | 44%  | 44%  | 45%  |
|  | Drift net earnings   | 54%  | 57%  | 62%  | 56%  | 59%  | 60%  | 59%  | 60%  |
|  | Set net earnings     | 29%  | 25%  | 35%  | 28%  | 38%  | 34%  | 33%  | 34%  |
|  | Total earnings       | 50%  | 51%  | 56%  | 50%  | 56%  | 55%  | 55%  | 56%  |
|  | Fish processing jobs |      |      |      |      | 83%  | 81%  | 85%  | 85%  |

Sources: Commercial Fisheries Entry Commission, Alaska Department of Labor

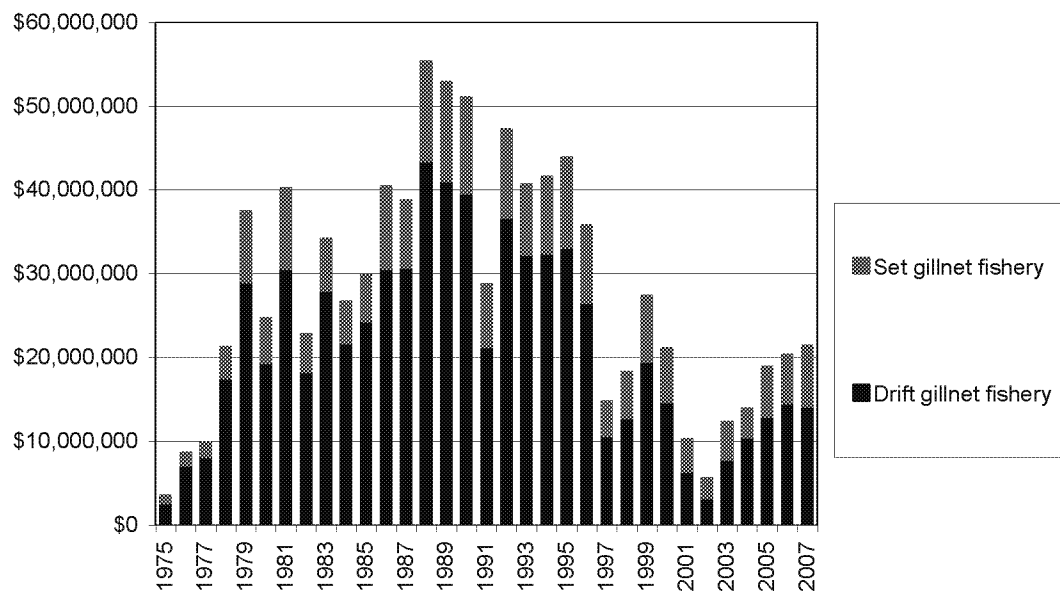
Most of the earnings in the Bristol Bay fishery do *not* go to local residents. The local resident share has declined significantly over time.

**Local Resident Share of Gross Earnings in Bristol Bay  
Commercial Fisheries**



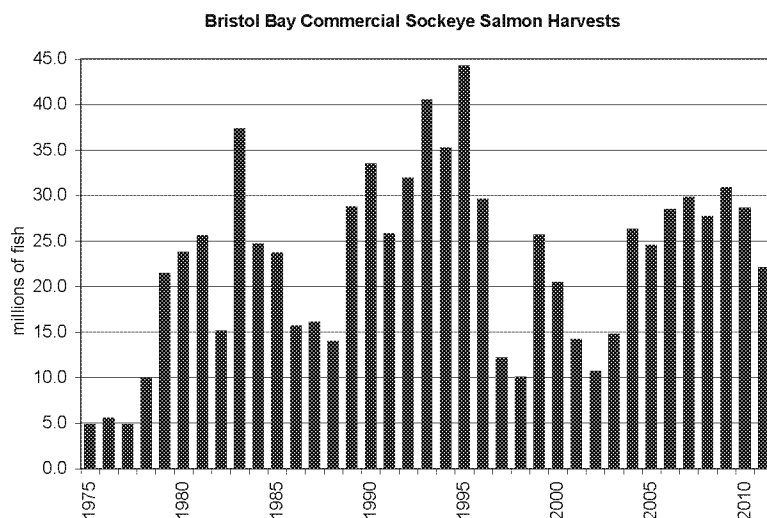
Nevertheless the fishery continues to represent an important source of income for Bristol Bay region residents

**Local Resident Gross Earnings  
in Bristol Bay Commercial Fisheries**



## Selected Issues for Assessing Potential Effects of Mining

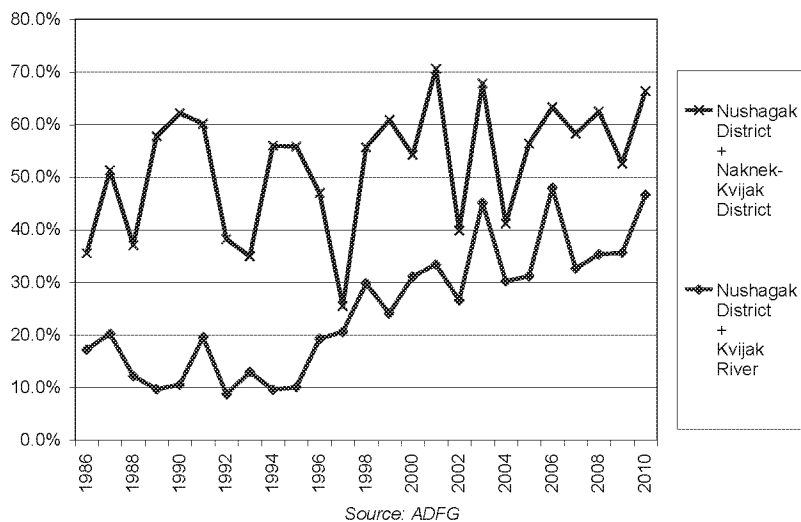
- Bristol Bay commercial harvests and prices vary widely from year to year and over longer-term periods
- There is no reliable way of precisely predicting future harvests, prices or value in the absence of mining
- No single historical year (or longer period) is necessarily “typical” or a good prediction of the future



*The assessment effort will have to make a choice of what to consider as the “baseline” for assessing potential impacts of mining.*

- EPA's analysis is focused primarily on the Nushagak and Kvichak watersheds—which are only part of the Bristol Bay commercial fishery
- The relative contribution of the Nushagak and Kvichak to the total commercial catch varies widely from year to year and over longer-term periods

Share of Nushagak & Kvichak in Bristol Bay Harvests: Two Measures



*The assessment effort will have to make a choice of what share of the commercial fishery to consider as potentially affected by mining.*

### 3. Other Fisheries and Values

Beyond commercial fisheries, Bristol Bay salmon support other important fisheries, economic activities and values

- Sport fisheries
- Subsistence fisheries
- Tourism
  - Salmon provide food for bears which tourists come to see
- Non-use values
  - Value people derive without using the resource directly
    - Preserving the option to use the resource in the future
    - Knowing that the resource exists

## Methodological challenges

- Much harder to measure and describe economic significance for these other fisheries and uses than for commercial fisheries
  - Much less data
  - Data less reliable
  - New data expensive to collect
  - Analysis of data more challenging
  - Concepts much more confusing



## Approaches . . .

- No major new primary data collection
  - Insufficient resources
  - Insufficient time
- Analysis based primarily:
  - Previously-collected data
  - Updated data collected by government agencies
  - Review and updating of past analyses

## Economic Significance of Recreational Direct Spending in the Bristol Bay Region

- Recreational sport fishery is a world-class resource.
- Recreational fishing, hunting, and non-consumptive recreation account for significant expenditures within the limited Bristol Bay economy by recreational visitors from outside the area.
- Recreational spending within the Bristol Bay economy by non-residents is a significant source of income and employment.
- Data for analysis of economic significance:
  - Expenditure data are based on individual surveys of recreational users, such as anglers or hunters.
  - Where information is lacking specific to Bristol Bay area recreation, estimates from other similar settings may be used.

Total Estimated Recreational Direct Spending Due to Bristol Bay Wild  
Salmon Ecosystems, 2005. (from Duffield, Patterson & Neher,  
*Economics of Wild Salmon Watersheds: Bristol Bay, Alaska*, February  
2007, prepared for Trout Unlimited, Alaska)

| Sector                       | Local<br>residents | Non-local<br>residents | Nonresidents | Total       |
|------------------------------|--------------------|------------------------|--------------|-------------|
| (A) Trips                    |                    |                        |              |             |
| Sport Fishing                | 12,957             | 8,530                  | 29,074       | 50,561      |
| Sport Hunting                | -                  | 1,538                  | 2,310        | 3,848       |
| Nonconsumptive<br>recreation | -                  | 1,000                  | 6,000        | 7,000       |
| Total trips                  | 12,957             | 11,068                 | 37,384       | 61,409      |
| (B) Spending                 |                    |                        |              |             |
| Sport Fishing                | 4,395,936          | 12,283,688             | 105,739,813  | 122,419,437 |
| Sport Hunting                | -                  | 2,214,720              | 10,870,860   | 13,085,580  |
| Nonconsumptive<br>recreation | -                  | 970,010                | 16,168,280   | 17,138,290  |
| Total direct spending        | 4,395,936          | 15,468,420             | 132,778,950  | 152,644,310 |

## Characteristics of Bristol Bay Subsistence Economy

- High reliance on fish and game
- Large number of specific resources harvested (70-80)
- Cash-subsistence based economy
- Long cultural tradition of subsistence harvest
- Extensive land areas used in subsistence harvest

Estimated Total Annual Bristol Bay Area Subsistence-Related  
Expenditures (2005) (from Duffield, Patterson & Neher, *Economics of  
Wild Salmon Watersheds: Bristol Bay, Alaska*, February 2007,  
prepared for Trout Unlimited, Alaska)

| <i>Area</i>                             | <i>Population<br/>2004</i> | <i>Percent<br/>Alaska<br/>native</i> | <i>Number of<br/>households</i> | <i>Number of<br/>Native<br/>Households</i> | <i>Number of<br/>non-native<br/>Households</i> |
|---|----------------------------|--------------------------------------|---------------------------------|--|--|
| Bristol Bay Borough                     | 1,103                      | 43.7%                                | 490                             | 214  | 276  |
| Dillingham Census Area                  | 4,924                      | 70.1%                                | 2,341                           | 1,641                                      | 700  |
| Lake & Peninsula Borough                | 1,584                      | 73.5%                                | 588                             | 432  | 156  |
| Total Bristol Bay Region                | 7,611                      | 67.0%                                | 3,419                           | 2,290                                      | 1,129  |
| Annual Spending/ household              |                            |                                      |                                 | \$2,780                                    | \$725  |
| Total Estimated<br>Subsistence Spending |                            |                                      |                                 | \$6,366,487                                | \$ 818,450                                     |
| <b>Total</b>                            |                            |                                      |                                 | <b>\$ 7,184,937</b>                        |  |

Selected results of earlier analyses of economic significance of non-commercial uses of Bristol Bay Salmon (from Duffield, Patterson & Neher, *Economics of Wild Salmon Watersheds: Bristol Bay, Alaska*, February 2007, prepared for Trout Unlimited, Alaska)

**Summary of Bristol Bay Wild Salmon Ecosystem Services,  
Net Economic Value per Year (Million 2005 \$)**

*Note: "Net economic value" refers to willingness-to-pay for the right or opportunity to harvest the resource, over and above costs of harvesting (even if the payment is not actually made)*

| <b>Ecosystem Service</b>      | <b>Low estimate</b> | <b>High estimate</b> |
|-------------------------------|---------------------|----------------------|
| Commercial salmon fishery *   | \$9.4               | \$18.8               |
| Sport fishing *               | \$13.5              | \$13.5               |
| Sport hunting                 | \$1.8               | \$1.8                |
| Wildlife viewing / tourism    | \$1.8               | \$1.8                |
| Subsistence harvest *         | \$77.8              | \$143.1              |
| <b>Total Direct Use Value</b> | <b>\$104.30</b>     | <b>\$179.00</b>      |
| Existence and Bequest Value   | Not estimated       | Not estimated        |

*\* Note: Widely differing methodologies were used to estimate net economic value for commercial, sport & subsistence fisheries.*

## 4. Economic Impacts of Fisheries

## Economic impact analysis

- “Economic impacts” are effects on the economy directly or indirectly attributable to an activity:
  - Employment, earnings, business sales
- We will use a standard “input-output model” approach to estimate economic impacts of Bristol Bay fisheries on the economies of:
  - The Bristol Bay region
  - The rest of Alaska
  - Other states
- Input-output modeling:
  - Hard to understand unless you work with it a lot
  - A standard and reasonably reliable economic technique



## How we will use impact output modeling . . .

- Start by estimating payments generated by different types of fishing to workers and to other industries, by region

|                        |                  |                | Where the payments go to |                |              |
|------------------------|------------------|----------------|--------------------------|----------------|--------------|
|                        |                  |                | Local region             | Rest of Alaska | Other states |
| Who the payments go to | Workers          |                | \$ aa                    | \$ bb          | \$ cc        |
|                        | Other industries | Transportation | \$ dd                    | \$ ee          | \$ ff        |
|                        |                  | Services       | \$ gg                    | \$ hh          | \$ ii        |
|                        |                  | Retail trade   | \$ jj                    | \$ kk          | \$ ll        |
|                        |                  | Etc.           | \$ mm                    | \$ nn          | \$ nn        |

- Use an “input-output model” to translate the expenditures into “impacts” within each industry and region
  - Employment, earnings, sales
- Impacts may be further divided into three types:
  - Direct (occur within the fishing industry)
  - Indirect (occur within other industries the fishing industry buys from)
  - Induced (caused when workers spend earnings in the economy)

|                                     |                | Region where the impact occurs |                |              |
|-------------------------------------|----------------|--------------------------------|----------------|--------------|
|                                     |                | Local region                   | Rest of Alaska | Other states |
| Industry in which the impact occurs | Fishing        |                                |                |              |
|                                     | Transportation | \$ dd                          | \$ ee          | \$ ff        |
|                                     | Services       | \$ gg                          | \$ hh          | \$ ii        |
|                                     | Retail trade   | \$ jj                          | \$ kk          | \$ ll        |
|                                     | Etc.           | \$ mm                          | \$ nn          | \$ nn        |

Estimated direct earnings from earlier economic impact analysis for Bristol Bay Salmon  
(from Duffield, Patterson & Neher, *Economics of Wild Salmon Watersheds: Bristol Bay, Alaska*, February 2007, prepared for Trout Unlimited, Alaska)

**Total Alaska Payroll Associated with Use of Bristol Bay  
Wild Salmon Ecosystems, 2005 (Million 2005 dollars)**

| <b>Payroll paid to:</b>     | <b>Commercial<br/>fishing</b> | <b>Sport<br/>Fishing</b> | <b>Hunting</b> | <b>Other<br/>Recreation</b> | <b>Subsistence</b> | <b>Total</b>     |
|-----------------------------|-------------------------------|--------------------------|----------------|-----------------------------|--------------------|------------------|
| <b>Local residents</b>      | \$34.554                      | \$8.180                  | \$1.536        | \$2.015                     | \$0.525            | <b>\$46.810</b>  |
| <b>Non-local residents</b>  | \$33.242                      | \$14.491                 | \$3.392        | \$4.235                     | \$1.183            | <b>\$56.543</b>  |
| <b>All Alaska Residents</b> | \$67.796                      | \$22.671                 | \$4.929        | \$6.250                     | \$1.707            | <b>\$103.353</b> |
| <b>Non Residents</b>        | \$52.694                      | \$4.303                  | \$0.087        | \$0.597                     | \$0                | <b>\$57.681</b>  |
| <b>TOTAL</b>                | \$120.490                     | \$26.974                 | \$5.016        | \$6.847                     | \$1.707            | <b>\$161.034</b> |